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***Policy Studies Journal* 2016**

DOI: http://dx.doi.org/10.1111/psj.12169

The Link between Contested Knowledge, Beliefs and Learning in European Climate Governance: From Consensus to Conflict in Reforming Biofuels Policy

This article was accepted by the Policy Studies Journal on 22.3.2016

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Abstract

The close link between scientific knowledge, learning and beliefs is particularly relevant in environmental policy making and the interaction of environmental with economic development-focused policies. This article contributes to a more refined understanding of the link between scientific knowledge, belief changes and the move from a collaborative to an adversarial policy subsystem within the Advocacy Coalition Framework. It analyzes the process of drafting and negotiating the biofuels aspects of the European Renewable Energy Directive, which was dominated by political disagreements between two advocacy coalitions. Their initial agreement on increasing the share of renewable energies in transport turned into conflict after new scientific evidence emerged on the negative environmental and climate change impacts of crop based biofuels. The environmental coalition changed its empirical policy beliefs to reflect normative policy beliefs on environmental protection. This change in empirical policy beliefs uncovered a pre-existing conflict with the normative policy beliefs of the economic development-focused coalition. As a consequence, the collaborative policy subsystem shifted to an adversarial policy subsystem.

Key words: Advocacy Coalitions, Beliefs, Biofuels, Climate Governance, European Union, Scientific Knowledge.

Introduction

Scientific knowledge plays an important role in public policy making, in particular in environmental policy. It contributes to changing existing beliefs among actors and reducing perceptions of uncertainty associated with policy problems and proposals to solve societal challenges (Weible & Sabatier, 2009). However, scientific knowledge can also have little effect on conflicting coalitions embedded across policy subsystems (Lodge & Matus, 2014), or even adverse effects and result in conflict among advocacy coalitions. Policy subsystems are semi-autonomous decision-making networks usually limited to a geographic boundary (Sabatier & Jenkins-Smith, 1993; Sabatier, 1987; Weible, 2008: 621). The Advocacy Coalition Framework (ACF) has been further developed from its original form (Sabatier, 1987; Sabatier, 1988) to allow a closer theoretical and empirical understanding of policy change (James & Jorgensen, 2009; Jenkins-Smith et al., 2014; Leifeld, 2013) and the role of disagreement among actors (Nohrstedt, 2011), including environmental politics (Boscarino, 2015). We also gained a better understanding of the role of science (James & Jorgensen, 2009; Lodge & Matus, 2014), beliefs (Jenkins-Smith et al., 2014; Pierce, 2011; Weible, 2005), learning (Albright, 2011) and the link between beliefs and coordination among multiple advocacy communities (Stritch, 2015). It offers central insights into explaining how shifts from consensual to contested scientific knowledge result in policy belief changes and ultimately conflict between advocacy coalitions (Weible & Sabatier, 2009; Weible, 2008).

The EU consolidated its renewable energy policy into the Renewable Energy Directive (EU, 2009a) as key element of the 2020 climate change strategy. One central component are biofuels as renewable energies in transport. Sharman and Holmes (2010) point in their study on how European biofuels policy emerged towards the important influence of one policy entrepreneur active

in the European Commission, in particular between 2007 and 2009. This individual did indeed play a leading role. However, additional evidence collected until 2013 long after that individual moved on to a different position indicates that there is more to this story, pointing towards a larger theoretical puzzle: A wider polarization of the issue between two advocacy coalitions occurred. Their disagreement emerged in 2007 when new scientific evidence on the negative climate effect of food crop based biofuels exposed conflicting beliefs and persisted until the reform proposal was adopted in 2015.

This raises two research questions. First, how does a change in scientific knowledge affect the beliefs of actors and the balance of power between groups advocating a certain policy? Second, how do these changes in beliefs and balance of power between advocacy coalitions influence the type of policy subsystem? This article contributes to a more refined understanding of the link between scientific knowledge, belief changes and the move between types of policy subsystems using a case study on European biofuels policy as part of wider European efforts to address climate change. This is a particularly relevant case as the biofuels subsystem is related to several policy areas ranging from renewable energy and climate change policy to agriculture and rural economic development. The case study sheds light on a gap in the literature on how science can become the subject of contested beliefs in a policy area that cuts across multiple policy subsystems.

Following a review of the literature on links between the Advocacy Coalition Framework, scientific knowledge and beliefs, this contribution introduces a conceptual framework to guide the empirical analysis of how the European biofuels policy subsystem turned from a collaborative into an adversarial policy subsystem following the introduction of new scientific evidence.

Scientific knowledge in the Advocacy Coalition Framework

Disagreements among policy makers can be understood by using the analytical lens of the ACF, which emphasizes that coalitions with diverging beliefs and policy objectives engage within an issue-related policy subsystem. They use different strategies to win over the other advocacy coalitions and achieve decisions by governmental authorities in line with their beliefs (Sabatier, 1988; Weible, Sabatier, & McQueen, 2009: 123). Policy change occurs either through events internal to the policy subsystem or due to external events that changed beliefs among advocacy coalitions within the policy subsystem (Weible, Sabatier, & McQueen, 2009: 124).

Advocacy coalitions emerge based on the beliefs of their members, who hold distinct deep core, policy and secondary beliefs. Deep core beliefs are fundamental worldviews and very stable. Policy beliefs can be understood as causal and normative perceptions spanning a policy subsystem, while secondary beliefs are less stable as they are limited to policy proposals on dealing with a specific problem in a particular case (Weible, Sabatier, & Lubell, 2004: 190). Policy beliefs can be further differentiated into normative policy beliefs and empirical policy beliefs. As policy beliefs are more specific than deep core beliefs, they are ideal for forming coalitions (Sabatier & Jenkins-Smith, 1993). Normative policy beliefs are closer to deep core beliefs as they consist of key values and welfare priorities, but are limited to a specific policy sub-system such as biofuels. Coalitions frequently split between the normative priorities for either economic development or environmental protection (Weible & Sabatier, 2009: 197). Empirical policy beliefs are linked to scientific findings and technical information, which makes them more open to change when new scientific evidence is introduced into the policy sub-system's debate (Weible &

Sabatier, 2009: 197). They can for example relate to causal links between carbon intensive crop based biofuels and food shortages in developing countries.

Scientific knowledge is used differently in the policy process, depending on the beliefs of the actors and the power of their advocacy coalitions. Knowledge can be used instrumentally, i.e. the decision-making follows the recommendations of independent research findings (Radaelli, 1995; Weiss, 1979), even if they contradict existing beliefs (Weible, 2008: 620). This can be linked to a positivist perspective that takes scientific findings 'at face value', which in turn requires that knowledge users trust the scientists who generated the knowledge. This in turn depends on how experts frame the issues and how the framing matches with beliefs (Lachapelle, Montpetit and Gauvin, 2014). However, scientific knowledge is frequently generated with a particular purpose, e.g. to address a problem, with research trajectories being "often decisively influenced through the application of political pressure by groups with a stake in the outcomes of research and the power and resources necessary to make their voice heard" (Sarewitz and Pielke 2007: 8). It can thus be understood as being socially constructed in its creation and use (Haas, 2004; Jasanoff, 1990).

Therefore, science needs to be interpreted taking the values of epistemic communities, beliefs, objectives and power relationships between actors into account. Epistemic communities are not only providers of knowledge, they also hold considerable power when faced with the choice of what aspects of their complex research findings they communicate to the public (Haas 1992; Nowotny, 2005). In the presence of contradicting scientific knowledge cultural identity can force actors to "choose between exploiting what they know and expressing who they are" (Kahan, 2015: 37). This in turn can motivate actors to use knowledge symbolically in a way that legitimizes their pre-existing political objectives (Radaelli 1995: 162) or supports their interpretation

of reality, especially when uncertainty and normative interpretations are involved (Sarewitz, 2004: 393). This political use of knowledge includes the distortion of knowledge or its selective use to counter arguments made by opposing advocacy coalitions (Weible, 2008: 620), which can also be understood as 'cherry picking' evidence (Holmes and Clark, 2008: 707). In both cases of instrumental and political use, the beliefs of actors do not change. Scientific findings can however also lead to a 'learning use', accumulating like sediments (Weiss, 1977) and gradually altering policy-makers' beliefs (Weible, 2008: 619-620) to reflect the scientific evidence. An important condition for learning to occur is that actors reflect on the scientific findings. Decisions are made within policy subsystems. Table 1 illustrates the differences between a collaborative and an adversarial policy subsystem.

[Table 1, please see Appendix]

The types of policy subsystems can shift over time. In their study of advocacy coalitions in Lake Tahoe, Weible and Sabatier (2009) found that the adversarial policy subsystem shifted to a more collaborative policy subsystem following a hurting stalemate between the actors. Weible (2008: 629) suggests that shifts from collaborative to adversarial policy subsystems occur when new actors from an external, competing policy subsystem join a collaborative policy subsystem or after the balance of power between actors has been altered by an external or internal event. In this context, similar beliefs among actors are important (Ingold and Fischer, 2014). In adversarial policy subsystems, scientists face difficulties to provide credible advice and disagreement in the scientific community tends to be higher (Montpetit 2011).

The link between scientific knowledge, beliefs and policy subsystems

The type of policy subsystem (e.g. collaborative or adversarial) depends on the beliefs of actors and the relative balance of power between their respective advocacy coalitions. Actors group together into advocacy coalitions with other actors who share their beliefs (Sabatier, 1988). These beliefs in turn limit the possible choice of policy preferences based on the extent to which the policy preference is supported by the belief (i.e. how a policy can achieve an objective based on the deep core beliefs of the actors). As new scientific knowledge emerges it encounters policy makers as 'gatekeepers', who evaluate it based on how well it fits with their existing beliefs, whereby "an expert whose message challenges the worldview of an individual will not enjoy the same level of credibility as another whose message comforts those same predispositions" (Lachapelle, Montpetit and Gauvin, 2014: 692). There are three potential reactions (i.e. uses of scientific knowledge) based on whether the new scientific knowledge a) fits with pre-existing policy beliefs (beliefs remain static), b) does not fit with pre-existing policy beliefs, which results in a reflection process and subsequent change in beliefs to fit with the new scientific knowledge (dynamic beliefs) or c) does not fit with pre-existing policy beliefs but is ignored (beliefs remain static). How static or dynamic beliefs are depends on the type of belief. In the advocacy coalition framework, deep core beliefs are most stable. Normative policy beliefs are also very stable and linked to the fundamental world views of deep core beliefs. Scientific knowledge is most likely to confirm or change empirical policy beliefs (Sabatier, 1988; Weible, Sabatier, & McQueen, 2009).

If the new scientific knowledge fits with the beliefs of the actor and supports pre-existing policy objectives (a), it is used to inform policy making. This matches with the instrumental use of knowledge (Radaelli 1995; Weible 2008). The new scientific knowledge reinforces pre-

existing beliefs and strengthens the power of all actors within this advocacy coalition as they benefit from the ability to use scientific findings to back-up their political objectives and in turn gain a higher credibility with the public and other, previously uncommitted actors. This gain in power due to an increased public credibility however blurs the distinction between the dominant instrumental use and an additional political use of knowledge at the same time. The advocacy coalition can use the scientific knowledge strategically to further strengthen its credibility and in turn discredit an opposing advocacy coalition. If the new scientific knowledge matches with all normative and empirical policy beliefs of all actors in the policy subsystem, it remains unchanged. Actors are likely to use the knowledge in the policy making process in a way that allows them to arrive at policies that also match the scientific knowledge.

It is however possible that new scientific knowledge does not fit with pre-existing beliefs (Lachapelle, Montpetit and Gauvin, 2014). If the new knowledge is not fundamentally opposed to the actors' deep core beliefs and normative policy beliefs, it is possible that they engage with the knowledge, reflect on it and deliberate its meaning for their empirical policy beliefs and secondary beliefs (b). They may change their empirical policy beliefs and be willing to align their policy objectives with the new scientific knowledge. This would be a learning use of scientific knowledge (Radaelli 1995; Weible 2008) that introduces a new dynamic into the otherwise static relationship between advocacy coalitions based on their static beliefs. If the new scientific knowledge helps to change the opposed advocacy coalitions' empirical policy beliefs to match with the beliefs of another advocacy coalition, a previously adversarial policy subsystem may change into a collaborative policy subsystem. If the change in empirical policy beliefs however divides two advocacy coalitions that were previously united in a collaborative policy subsystem

defined by shared empirical policy beliefs and secondary beliefs in the form of overall policy objectives, this collaborative policy subsystem may turn into an adversarial policy subsystem.

In the third option (c), the scientific knowledge fundamentally opposes the deep core beliefs and normative policy beliefs of actors. The actors decide not to reflect on the new scientific evidence or their reflection results in the decision to ignore the evidence because the scientific knowledge conflicts with fundamental world views, i.e. deep core beliefs. Instead, they enter a state of defensive avoidance (Janis and Mann, 1977). As in a), the beliefs remain static. The beliefs and the related policy objectives are however in conflict with the new knowledge. The advocacy coalition turns to a political use of scientific knowledge by trying to ignore, bury or discard it to prevent the knowledge from entering the political debate (Radaelli 1995; Sarewitz and Pielke 2007) and being used by an opposing advocacy coalition to support its political objectives (Sabatier, 1988). These conflicting policy beliefs indicate an adversarial policy subsystem with two or more advocacy coalitions pursuing their policy objectives based on conflicting beliefs.

How one advocacy coalition deals with the uncomfortable knowledge depends on how powerful it is in relation to the opposing advocacy coalition (Radaelli, 1995). If the advocacy coalition holds a knowledge monopoly over the new scientific information, it can discard, ignore, bury or even censor the information so that the other advocacy coalition cannot access the information and use it to support its policy objectives. If however the advocacy coalitions' power is limited by the scientists' proactive dissemination strategy, a multitude of scientific studies confirming the same results and subsequent media attention, the political use of the knowledge shifts towards a defensive strategy. The advocacy coalition tries to discredit the new information by doubting the scientific value, pointing towards uncertainty and methodological challenges or producing counter-evidence to demonstrate that the scientific knowledge is not consensual, but con-

tested within the scientific community, thus creating a situation that allows policy makers to cherry-pick the evidence that supports their objectives (Sarewitz and Pielke 2007; Sharman and Holmes, 2010). The advocacy coalition subsequently changes the parameters of the debate, thus politicizing the other advocacy coalitions' use of the scientific evidence. Figure 1 illustrates the link between knowledge usage (instrumental, political, learning) and the subsequent repercussions to the format of the policy subsystems (collaborative or adversarial) and the balance of power between the advocacy coalitions within the policy subsystems. It is however important to point out that instrumental and political use of knowledge and learning are not mutually exclusive, but can be used by actors simultaneously, for example when some subsystem actors use knowledge instrumentally while others learn, both across and within advocacy coalitions. The balance of power between and within advocacy coalitions is an important determining factor, in particular when different types of knowledge use co-exist within one advocacy coalition. The more powerful the actors, the higher their influence is on how the overall advocacy coalition reacts to the scientific knowledge, which in turn shapes the form of the policy subsystem. This contribution is compatible with previous findings in the ACF literature. Subsystems can still change, even if knowledge is used only instrumentally or politically. This is particularly the case when external changes occur, such as the emergence of new actors, a reorganization of advocacy coalitions or external influences such as the salience of an issue on the political agenda and the level of public attention (see for example Lodge & Matus, 2014 and Weible & Sabatier, 2009).

[Figure 1, please see appendix]

Propositions

Based on previous findings in the advocacy coalition literature (Weible & Sabatier, 2009; Weible, 2008: 629), two hypotheses can be formulated to examine the biofuels controversy as analytical puzzle. This analysis centers on the shift from collaborative to adversarial policy subsystems *because* of scientific knowledge that changed one coalition's empirical policy beliefs and exposed previously incompatible normative policy beliefs.

Proposition 1:

A shift from a collaborative policy subsystem to an adversarial policy subsystem will occur when new actors begin to participate from a competing policy subsystem and/ or after an internal or external event alters the balance of power between existing coalitions.

Proposition 2:

In adversarial policy subsystems, (a) scientific knowledge is predominantly used politically, while (b) learning within advocacy coalitions is high, but low between advocacy coalitions.

Testing these two propositions seeks to address a distinct gap in the literature. So far, the literature explaining changes from collaborative to adversarial policy subsystems has focused on additional actors or internal/ external influences. There has been little analysis on the influence of new scientific evidence on changing empirical policy beliefs and in turn changing the type of policy subsystem. The key hypothesis is that these changes can occur even if no new participants emerge from other policy subsystems, i.e. that it can occur not only due to changes from outside, but also inside the existing policy subsystem. Shifts can result from one group changing its em-

pirical policy beliefs due to the introduction of new scientific evidence that coincided with the normative policy beliefs of one advocacy coalition, but not with the beliefs of the other advocacy coalition. The change in empirical policy beliefs uncovers a pre-existing conflict between normative policy beliefs. As a consequence, the collaborative policy subsystem shifts to an adversarial policy subsystem. This contribution proceeds with the empirical analysis of the case of reforming European biofuels policy.

The role of scientific knowledge in turning EU biofuels from a collaborative into an adversarial policy subsystem

Methodology

The findings on European biofuels policy are based on interviews with 41 key individuals (predominantly in 2012/13) and the analysis of policy documents. Interviewees were involved in negotiating the European Renewable Energy Directive (EU, 2009a) and the 2015 Indirect Land Use Change Reform to the related Fuels Quality Directive (2009b). The key actors interviewed were officials from the Directorate Generals (DG) of Energy, Agriculture and Rural Development, Environment and Climate Action at the European Commission (22 interviews), representatives of EU member states (6 interviews), Members of the European Parliament (5 interviews), NGO and think tank representatives (4 interviews) and lobbyists from agriculture/ biofuels industry (4 interviews). All actors were deeply involved in the policy making process and were identified by asking interviewees who they observed playing a key role. All interviews were conducted with the understanding of anonymity. They were semi-structured and lasted around 60 minutes. The interviews focused on the exact involvement of the interviewees, their beliefs, which interests

they represented and changes they observed in their or others negotiation positions and beliefs. The interview transcripts were coded and analyzed using process-tracing (Collier, 2011; Hall, 2013). Key themes were the role of scientific evidence, changes in beliefs and shifts from a collaborative to an adversarial policy subsystem.

The identification of actors with advocacy coalitions is similar to the qualitative approach used by Lodge and Matus (2014). It was undertaken based on the beliefs actors emphasized during the interviews. Beliefs and thus the existing advocacy coalitions were determined by coding the interviewees' responses to questions related to their world views, whether they saw a problem with using biofuels, including underlying reasons, and their policy priorities. The key belief determining membership in advocacy coalitions was whether or not the actors prioritized environmental protection and reducing carbon dioxide emissions over (rural) economic development and energy security. Those stressing the importance of addressing climate change over economic development were coded as holding environmental deep core and normative policy beliefs, with policy preferences for less biofuels and thus belonging to the environmentally minded coalition (highlighted with 'ENV' added to their numeric code in the next section). Interviewees who regarded economic development as a higher priority than addressing climate change and expressed policy preferences in favor of increasing the share of biofuels in the fuel mix were coded as holding deep core and normative policy beliefs focused on economic development and thus belonging to the economic development focused coalition (highlighted by 'ECDEV' added to their numeric code in the next section). If beliefs remained static, knowledge was either used predominantly instrumentally or politically. The learning use of knowledge was indicated by references in the interviews to a) cognitive reflection on the new scientific evidence and b) changes in beliefs, i.e. if 'actors came to see things differently' or 'changed their mind', subsequently adapting their policy

preferences (see Figure 1 on links between use of knowledge, and changes in beliefs and policy subsystems). This classification was compared with statements made by other interviewees. Membership in the coalitions was determined via the beliefs emphasized by the interviewees and, if applicable, the guidelines of the organization they were working for and representing throughout the policy making process. This is relevant since once an organization has formed an official position on an issue, civil servant actors need to represent this position regardless of their personal beliefs or whether their personal beliefs changed later.

The ACF specifies a number of assumptions underlying the analysis (Weible, Sabatier, & McQueen, 2009: 122). First, scientific and technical information plays a key role in the biofuels case as new information resulted in shifts among the coalitions. Second, it requires a time frame of at least 10 years to allow for a meaningful analysis. The biofuels case spans from the negotiation of the first Biofuels Directive in 2002 to the conclusion of the Indirect Land Use Change reform amending the Renewable Energy Directive (EU, 2009a) of May 2015, thus covering a total of 13 years. Third, policy subsystems need to be the primary unit of analysis. Biofuels policy is a policy subsystem with overlaps to the policy subsystems on climate change, energy and agriculture. Fourth, a wide range of actors is required. The actors in the biofuels policy subsystem are civil servants at the European Commission, Members of the European Parliament, member state representatives, environmental NGOs, think tanks and the biofuels industry. All act as boundedly rational individuals that rely on beliefs as means of processing stimuli. Finally, the ACF assumes that policies are understood as translation of beliefs (Weible, Sabatier, & McQueen, 2009: 122).

Development and reform of biofuels policy in the EU

Biofuels are part of several European directives. The Renewable Energy Directive (EU, 2009a) is linked to the EU's 2020 climate strategy with a reduction of greenhouse gas emissions by 20 per cent compared to the 1990 baseline, a share of renewable energies of 20 per cent and improving energy efficiency by 20 per cent (European Council, 2008). The biofuels aspect of the Renewable Energy Directive was developed as logical consequence of the 2001 Renewable Electricity Directive (Rowlands, 2005) and the 2003 Biofuels Directive. It is also linked to the Fuel Quality Directive (EU, 2009b), the Common Agricultural Policy and the most recent policy reform on Indirect Land Use Change, which took four years of negotiation. European biofuels policy has been analyzed by a number of academic contributions. Dunlop focused on national-level implementation (2010). Hildingsson, Stripple and Jordan (2012) analyzed the governance dilemmas related to policy making in renewable energy on the European level. This case contributes to the literature on the role of science and knowledge in policy making, which also makes references to interest coalition formation and learning (e.g. Dunlop 2009; Jasanoff 1990; Lachapelle, Montpetit and Gauvin, 2014; Radaelli 1995; Weible, Sabatier, and Lubell 2004). A gap remains on how changes in scientific knowledge influence beliefs and the type of policy subsystem.

Collaborative policy subsystem (pre-2007)

The biofuels component of the Renewable Energy Directive emerged from actions across different DGs of the European Commission between 2005 and 2007. DG Agriculture was working on a biofuels strategy resulting from the implementation of the Common Agricultural Policy reform, which inproved greening measures and reduced subsidies in the sugar regime (European Council, 2006; Sharman & Holmes, 2010).

> [Agriculture] Commissioner Fischer-Böhl, who was wrapping up the sugar reform, (…) had huge opposition from the farm lobby, and she found the magic way of sugar coating, the deal of saying [to the farmers] 'we lower your guaranteed price of sugar, but don't worry, you'll make lots of money through biofuels' (ENV Environmental NGO [ENGO] 1).

Between 2005 and 2007 DG Environment was working on the Fuel Quality Directive (EU, 2009b). At the same time, DG Transport and Energy was drafting the biomass action plan (EC, 2005) on how biomass could best be used, but "what it ended up being was very much a sort of selling job on why we needed more biofuels in transport, rather than looking at where it would be optimal to use biomass" (ECDEV European Commission [EC] 8). Another parallel development was the discussions regarding the carbon dioxide emission standards of cars. Several actors including the car industry, the agricultural lobby and two DGs were pushing for a more reliable biofuels target that would go beyond the existing voluntary target of 5.75 per cent (ECDEV EC 8; ENV EC 9; ENV ENGO 2), while "at that point it was specifically biofuels and not renewables in transport" (ENV EC 10). The European Council requested the European Commission to propose a set of directives that would deliver on the 2020 20-20-20 strategy (European Council, 2008) that also included 10 per cent biofuels (European Council, 2007: 21; ECDEV MS [Member State] 2).

> [DG Transport and Energy] published [the Renewable Energy Roadmap] in January and then a combination of very intensive discussions by everybody evolved, (…) we persuaded enough people that we were utterly right so that by March of 2007 the European Council actually endorsed the approach and called for the proposal to have a legally binding 20 per cent renewables target (ECDEV EC 8).

Ultimately, the targets were more based on political objectives than on scientific data or impact assessments (Sharman & Holmes, 2010). This increasingly linked into the overall

positive narratives on renewable energies, of which biofuels were an important aspect. Originally developed during the fuel shortages of the Second World War (ECDEV MS 3) and the 1970s oil crises, biofuels were seen as a means of energy security and were never something that was developed primarily for environmental purposes" (ECDEV EC 12). As climate change emerged strongly on the political agenda with the need to implement the Kyoto Protocol, increasing the share of renewable energies was seen as logical response to fulfill international commitments along with improving energy efficiency (ECDEV EC 1; ECDEV EC 2; ECDEV EC 4). Biofuels were welcomed by actors concerned with policy preferences for rural economic development, energy security and climate change mitigation alike:

> Member states probably understood that using increased shares of renewables, there could be something in it for them in terms of industrial policy, energy policy, less energy dependence, because renewables are exceptionally domestic; (…) renewables have always been quite popular in most countries (ECDEV EC 2).

A shared assumption among actors was that

> In 2003 it was fairly clear that there were clear greenhouse gas savings from nearly every process in biofuels and the consensus seemed to be that the indirect land use changes were insignificant, so that was 2003. I guess by the time we were drafting the directive that had changed completely (…). The anti-biofuels arguments (…) certainly occupied us thoroughly from 2007 onwards (ECDEV EC 8).

There was a consensus regarding actor's empirical policy beliefs (ENV EC 15) that alternatives to fossil fuels should play a larger role in the European energy mix, which facilitated the adoption of the directive. This resulted in a collaborative policy subsystem with shared empirical policy beliefs that facilitated the negotiation of the 2003 Biofuels Directive and the overall EU Climate Package, which contained the 2009 Renewable Energy Directive with its biofuels component.

Shift to adversarial policy subsystem (post 2007)

After the lock-in into the de-facto 10 per cent target on biofuels in the fuel mix[1] following the European Council's decision, new scientific evidence was introduced into the debate in 2007. Scientists published their research findings, which were taken up by social NGOs. These made the link between increasing food prices in Africa and the increased changes in land use to produce crop based biofuels in the United States and in the EU (Runge & Senauer, 2007). This resulted in a split of the policy subsystem along pre-existing normative policy beliefs and the formation of two advocacy coalitions, ECDEV and ENV. ECDEV drafted the biofuels aspects of the Renewable Energy Directive based on the assumption that biofuels were beneficial for climate policy, rural economic development and energy security alike. It consisted of individuals working for DG Transport and Energy, the biofuels industry, MEPs and economic growth focused departments in member states.

The new scientific evidence revealed that not all types of biofuels had a positive effect on climate mitigation; but in parts have a worse carbon footprint than fossil fuels (Fargione, Hill, Tilman, Polasky, & Hawthorne, 2008; Jacobsson, 2008; Searchinger et al., 2008). Furthermore, ethanol from sugar and maize as well as biodiesel from rapeseed competes with the provision of food either directly in the case of sugar and maize (Runge & Senauer, 2007) or indirectly as food needs to be produced elsewhere. This leads to the conversion of carbon sinks such as forest covered areas into agricultural land and results in carbon emissions from indirect land use changes (Lange, 2011). The increased demand for agricultural land and direct competition of biofuels

[1] The Renewable Energy Directive states 10 per cent of renewable energy in transport to include electric cars. Since their share was however expected to remain small until 2020 compared to biofuels, the target became a de-facto biofuels target.

with food production was linked the food crisis of 2007/08 of rising food prices in Africa. This resulted in a 'food versus fuel' debate among NGOs and in the media (Runge & Senauer, 2007). The stable consensus that renewable energies were desirable was challenged by the scientific evidence that not all renewable energies had the same carbon neutral performance, especially if their indirect effects for land use changes were taken into account. The new evidence presented by scientists regarding the negative climate mitigation performance of certain types of biofuels was picked up by NGOs and the media and entered the public sphere via the 'food versus fuel' debate. Yet even the environmentalists had until then been either indifferent or in support of biofuels:

> The negative reaction first came from the social NGOs, and it took several years for environmental NGOs to take notice and to talk about the problem while saving face. Because it is also not possible that you are pushing for an ambitious target and two years later you are saying that the target is causing a problem. So they needed a few years and a few changes in personnel and terminology to explain themselves, but others who were not implicated in the early push in favor of biofuels, they were much quicker to react (ENV EC 15).

Until the new scientific evidence emerged, there was a consensus among most key actors involved that climate change needed to be addressed and that renewable energies, including biofuels, were a suitable policy instrument to achieve this objective. The new scientific evidence challenged these underlying empirical policy beliefs formed since the 1970s. These had developed into a societal consensus in favor of renewable energies by the early 2000s (ECDEV EC1). Not all groups involved reflected on the new scientific input in the same way. ECDEV actors did acknowledge the new evidence, but viewed it as contested with regards to its effect on food prices, thus maintaining their original empirical policy beliefs that biofuels are beneficial for energy security and rural development. Their beliefs still acknowledged that some aspects of biofuels

can be useful for addressing climate change based on the sustainability criteria introduced into the Renewable Energy Directive (EU, 2009a) via the Fuel Quality Directive (EU, 2009b), resulting in the observation that biofuels "have the highest criteria (…) to meet before they can be used, (…) but nobody cares about what happens to the rest," (ECDEV EC 4) such as palm oil:

> The timing was such that all sorts of practically everything [that] was bad in the world was being blamed on biofuels. (…) The fact that EU biofuels demand was so trivial and barely significant didn't matter at all. People just saw high food prices and EU demand and said that it was EU energy policy driving all of this (ECDEV EC 7).

This resulted in two coalitions with differing beliefs. Especially ENV actors such as environmental NGOs and environmentally minded departments within the European Commission and in the member states reflected on the new scientific evidence and came to change their empirical policy beliefs on the climate performance of biofuels.

Use of scientific knowledge: uncertainty, political use and learning forums

The situation of differing empirical policy beliefs between ENV and ECDEV uncovered their incompatible normative policy beliefs regarding the principled priority of climate mitigation and environmental protection. Renewable energies including biofuels were still widely regarded by ECDEV as desirable alternative to fossil fuels from an energy security and economic development perspective as part of their normative policy beliefs (ECDEV EC 1; ECDEV MS 1; ECDEV MS 4; ECDEV MS 5; ECDEV MS6). Some reflected on the evidence and decided to ignore it, i.e. entered into defensive avoidance (Janis and Mann, 1977), which was facilitated by group think (Janis, 1972) as they were in the 'driving seat', i.e. in charge of negotiating the details of

the legislative proposal. The key strategy of ECDEV was to use the uncertainty around the scientific knowledge as political weapon to shed doubt on the scientific evidence:

> It was also the scientific community that was having different ideas and giving contradictory advice, so that certainly did not help in giving policy makers a clear signal, and that was giving room to different lobbies to go for their own interests. So from a political perspective you had the [economic development focused and] agricultural lobby in favor, you had the environmentalists being more concerned about the issues, but science was in a way not giving a clear signal to either of the two, and that caused a difficult discussion where the [European] Commission [DG Transport and Energy] was quite dominant, because there was a lot of arguments going back and forth, and if the science is not very clear, then it is the [European] Commission who can play around with that (ENV EP 4).

The disagreement within the European Commission regarding these empirical policy beliefs was so strong that it could not find a common language to respond to the 'food versus fuel' media debate during the drafting process in 2007/08, so that due to the "different views inside the Commission, it was not possible for the Commission to externally express any opinion or even any scientific response to the statements that were being made" (ECDEV EC 5). The negotiations were less based on scientific evidence but on political horse-trading (ECDEV EC 6; ENV EC 9; ENV EC 12) and policy-based evidence gathering (Sharman and Holmes, 2010). The controversy between the advocacy coalitions in the now adversarial biofuels policy subsystem within the European Commission forced the key actors to deepen their expertise regarding the new and contested knowledge, taking "up a vast amount of effort and resources" (ECDEV EC 8).

Each advocacy coalition called upon experts to explain technical details of measuring carbon footprints of biofuels and effects on indirect land use changes. Especially the ECDEV advocacy coalition was commissioning additional studies and looking for alternative evidence to con-

test the scientific findings that emerged in 2008 and were readily used by the ENV advocacy coalition. As each needed to defend their empirical policy beliefs in the discussions with the other advocacy coalition, actors engaged in cherry-picking strategies by looking for evidence to support their arguments. They however also examined the issue from different angles and thereby reflected on their own normative policy beliefs. Actors acquired more knowledge by looking for supporting arguments and evidence, as well as improved their strategies in influencing the policy making process. ECDEV actors however did not engage in a learning use of knowledge in the form of changing their empirical policy beliefs (Weible, 2008). However, even if actors in ECDEV had wanted to engage in a learning use by changing their empirical policy beliefs on biofuels, their path-dependent lock-in to the 10 per cent target would have meant a loss of face, what was avoided by entering into defensive avoidance (i.e. non-reflection on evidence contrary to actors' beliefs) (ECDEV EC 4):

> I think the whole thing had gotten really emotional. (…) I also think there was this sort of psychological mechanism of denial, you know, that you don't want to admit a piece of evidence that goes against what you really think is right (ENV EC 12).

It is important to recognize that the ECDEV advocacy coalition did not have the 'luxury' of reflecting on the new evidence to subsequently change its position. A key observation is that the debate shifted towards a consensus on the negative impacts of biofuels *after* the ECDEV advocacy coalition had succeeded in gaining a political mandate for the 10 per cent target in the Council by the Heads of States and was therefore 'locked-into' a position that was difficult to change without a loss of face:

> What was also very clear that from the Commission's [DG Transport and Energy] perspective, they were already married to their 10 per cent target so to say, so they didn't want a too funda-

> mental discussion on the targets, (…) [but they were] very much pushing of keeping these targets and trying to downplay the scientific debate there (ENV EP 5).

And

> This was a kind of a classical political deadlock we had there, because the politicians already agreed to come forward with a 10 per cent target on renewables for transport, and politically it was already impossible to give up that target, that would have been seen as a loss of face, you know these kind of political issues that sometimes become more important than scientific arguments (ENV EP 4).

Discussion

The case study on European biofuels policy illustrates how empirical belief changes among one coalition due to new scientific evidence can shift a collaborative policy subsystem to an adversarial policy subsystem. In the collaborative policy subsystem between 2000 and 2007, the coalitions held differing deep core and normative policy beliefs, but the empirical policy beliefs were sufficiently close for a collaborative policy subsystem. The deep core beliefs of ENV actors were deep green; while the deep core beliefs of ECDEV members were focused on economic development and energy security. These deep core beliefs remained stable throughout the biofuels controversy, what matches with the stability assumption of the ACF (Sabatier, 1988; Weible and Sabatier, 2009). Also, the normative policy beliefs of both coalitions remained unchanged by the emergence of the new scientific evidence. ENV believed in a principled priority of environmental sustainability, while ECDEV was guided by its normative policy belief in a principled priority of economic development. Both coalitions however were able to cooperate in a collaborative policy subsystem because their empirical policy beliefs were aligned before 2007, when actors understood all biofuels as desirable means to address climate change. This belief formed a win-win

constellation with the ECDEV objectives of improving energy security and rural economic development. Only the scientific evidence that emerged in 2007/08 changed the empirical policy beliefs of ENV to remain in sync with its normative policy beliefs, making crop based biofuels unacceptable. This change of beliefs can be understood as learning (see Figure 1). ENV subsequently demanded that crop based biofuels be limited to their current level and ideally phased out soon.

The use of scientific knowledge remained relatively stable over time. We would expect that the initial collaborative policy subsystem used scientific evidence instrumentally (Weible, 2008; Weible and Sabatier, 2009). However, there was first of all not much scientific evidence on the environmental impact of renewable energies available, and second an overall enthusiasm for all types of renewable energies as primary response to address climate change (ECDEV EC 1). Thus, the existing scientific evidence was primarily used politically by both coalitions to justify the political targets on biofuels. The scientific evidence on climate change itself however, provided by the Intergovernmental Panel on Climate Change, was used predominantly in an instrumental way within the overall collaborative policy subsystem on climate change. After the publication of the negative climate effects of biofuels in 2007/08, both coalitions used competing studies politically to underpin their negotiation positions. Table 2 illustrates the overlapping and competing beliefs among the two key coalitions.

[Table 2. Belief changes among the two advocacy coalitions. Source: Author, see appendix]

The empirical analysis also illustrated that there are two levels of beliefs: the personal beliefs of the individual and the organizational beliefs of the organization the individual represents

in the policy making process. The line between those levels was blurred during the collaborative policy subsystem. As the new scientific evidence on the adverse environmental and climate change effects of biofuels emerged, the adversarial policy subsystem formed based on organizational positions and priorities. The normative beliefs embedded into the mission of DG Environment, DG Climate Change, environmental NGOs and Green Party representatives in the European Parliament were to prioritize climate change mitigation and environmental protection over economic considerations if these were in conflict (while at the same time looking for policy solutions that allow co-benefits). In the majority of cases, the interviewed individuals emphasized that the organizational normative beliefs also match with their personal normative beliefs of prioritizing the environment over economic development (e.g. green beliefs). ECDEV members also followed their organization's normative beliefs on prioritizing economic development while addressing climate change if co-benefits for the primary mission could be secured. If personal beliefs matched with organizational beliefs, such as for the majority of member state representatives, DG Agriculture and Rural Development as well as DG Transport and Energy, the new scientific evidence was discarded as less relevant than the remaining benefits of biofuels for the other objectives of energy security and (rural) economic development. However, at the heart of the biofuels controversy stood a group of individuals who self-identified with green beliefs, but were working for DG Transport and Energy. Due to the mismatch between personal and organizational normative beliefs, these individuals entered into defensive avoidance (Janis and Mann, 1977) and focused on contesting the scientific evidence on the negative climate performance of biofuels in the search of evidence to support their initial empirical beliefs of co-benefits from biofuels for climate mitigation, energy security and economic development. This group had played a key role in getting the Heads of States to support the 10 per cent de-facto biofuels target in the European Council decision in 2005, creating the policy lock-in at a time of insufficient scientific

knowledge on the effect of biofuels on the environment and climate change. They thus needed to save face by maintaining their initial empirical policy beliefs.

The new scientific evidence had a different effect on ENV actors, in particular the environmental NGOs who initially were also very supportive of biofuels. They needed time and changes in personnel to adapt their position and publicly announce their change of empirical policy beliefs. This time lag allowed the environmental NGOs to 'save face' while changing their empirical policy beliefs to match the new scientific evidence on the negative climate change effects of food crop based biofuels. Both groups needed time and shifts in personnel to 'save face', but only ENV was able to change their empirical policy beliefs. The key difference is the alignment with the underlying normative policy beliefs. ENV was able to re-align their empirical policy beliefs with their normative policy beliefs by embracing the new scientific evidence, which was not seen as a 'loss of face', but as embracing new knowledge and thereby learning. ECDEV actors had to follow their organizational objectives and normative policy beliefs prioritizing economic development, which did not allow for an adjustment of empirical policy beliefs and thus resulted in defensive avoidance, political use of knowledge and avoiding a loss of face.

The biofuels case study offers little evidence in favor or against the first proposition, namely that "*A shift from a collaborative subsystem to an adversarial subsystem will occur when new actors begin to participate from a competing policy subsystem and/or after an internal or external event alters the balance of power between existing coalitions" (Weible, 2008: 629).* Instead, it illustrates a refined perspective and additional reason for shifts from collaborative to adversarial policy subsystems. The actors remained the same between 2003 and 2015, with no significant new actors entering around 2007/2008 when the shift occurred. The shift can also not be explained by an internal or external event altering the balance of power between the existing coa-

litions, as ECDEV remained 'in the driving seat' throughout the development and adoption of the Renewable Energy Directive. A power shift could have occurred in the Indirect Land Use Change reform of 2011-2015 via the Fuel Quality Directive (EU, 2009b) controlled by ENV, which attempted to limit the use of crop based biofuels to current levels. This discussion however lasted four years with incremental changes that hardly go beyond the sustainability criteria enshrined in the Renewable Energy Directive and the Fuel Quality Directive. The Indirect Land Use Change reform was too incremental to point towards a relevant power shift between the coalitions. Instead, the biofuels case illustrated that the policy subsystem shift occurred *because* of the emerging new scientific evidence on the negative environmental effects of biofuels, which exposed pre-existing deep core and normative policy beliefs.

The case study sheds new light on findings by Weible and Sabatier (2009). They found that in the case of environmental protection, tourism and city planning at Lake Tahoe, scientific evidence on environmental impacts facilitated a gradual shift from an adversarial to a collaborative policy subsystem as evidenced by converging policy and secondary beliefs among the coalitions. In the biofuels case, the empirical policy beliefs did in fact converge among the advocacy coalitions in the collaborative policy subsystem until 2007/08. The normative policy beliefs however remained opposed with principled priority given to either the environment or economic development. These normative policy beliefs were incompatible from the start and only 'covered up' by the consensus that all renewable energies including biofuels were good, which was formed at a time characterized by a vacuum of scientific evidence. So far, the assumption was that scientific knowledge helps actors in a collaborative system to learn by deliberating, and actors in adversarial systems to modify their beliefs towards convergence. Yet, as pointed out by Lubell (2004) and acknowledged by Weible et al. (2004) and Weible and Sabatier (2009: 207-208), this

assumption may be 'all talk and no action'. The emergence of new scientific evidence in the 2007 collaborative biofuels subsystem did not result in more convergence, but led to the shift towards the adversarial policy subsystem. At that stage, actors entered into a political use of their diverging interpretation of scientific evidence, i.e. empirical policy beliefs, instead of acknowledging the opposing normative policy beliefs. It could be argued that the absence of scientific evidence on the environmental performance of biofuels allowed the collaborative subsystem to emerge in the first place, as actors perceived their empirical and normative policy beliefs to be in a 'win-win' constellation.

Proposition 2 stated that *in adversarial policy subsystems, (a) scientific knowledge is predominantly used politically, while (b) learning within advocacy coalitions is high, but low between advocacy coalitions* (Weible and Sabatier, 2009). This has been widely confirmed by the biofuels case study. Actors used scientific evidence politically to justify their positions and made use of the availability of competing studies to legitimize their arguments against opponents. In the high-conflict situation of the adversarial policy subsystem, learning occurred within coalitions and did in fact reinforce actors' preexisting beliefs (Litfin, 2000: 249; Weible et al., 2009: 190). Learning among actors did occur in both the collaborative and the adversarial policy subsystem within the coalitions. Actors reflected on new information and ENV changed their empirical policy beliefs. Contrary to the expectation suggested by Weiss (Weible et al., 2009; Weiss, 1977) that scientific knowledge needs to accumulate over a certain period of time like sediments, the shift in the biofuels case happened quickly due to the emergence of a few studies illustrating the negative scientific evidence on biofuel's carbon intensity (e.g. there was a strong emphasis of interviewees on the Searchinger et al., 2008 study). This suggests that an sufficient amount of scientific evi-

dence is necessary (Weiss, 1977), but there is a tipping point when just enough evidence exists to satisfy policy makers. This can happen before a strong 'sedimentation' saturates.

The normative policy beliefs did not change, but once their divergence was exposed, the policy subsystem shifted from collaborative to adversarial. This continued throughout the Indirect Land Use Chance reform when key actors were forced to negotiate a reform despite ongoing conflict about diverging empirical and normative policy beliefs. Due to the institutional set up of the European Commission and the need to arrive at an agreement between the DGs, the negotiations entered into a 'deliberation' phase forcing actors to closely engage with scientific evidence and justify their empirical policy beliefs, while still using the evidence politically in support of their beliefs. In conclusion, evidence was less used instrumentally, but overall politically in the collaborative *and* the adversarial subsystem with learning within the ENV advocacy coalition.

Conclusion

This article contributed to a more refined understanding of the link between scientific knowledge, belief changes, learning and the move from a collaborative to an adversarial policy subsystem. It analyzed the process of drafting and negotiating the biofuels aspects of the European Renewable Energy Directive, which was dominated by political disagreements between two advocacy coalitions after new scientific knowledge emerged. The biofuels case is relevant as it cuts across several pieces of legislation. The responsibility of developing a policy proposal usually falls to one advocacy coalition. The biofuels case helped to illustrate the interactions of two advocacy coalitions as they used their own areas of responsibility to "put their marker on" (ECDEV EC 8) and to align the policy with their own normative policy beliefs. Actors' initial agreement on increasing the share of renewable energies in transport by de-facto using biofuels given the absence of

technologically viable alternatives at the time turned into conflict after new scientific evidence emerged on the negative impacts of crop based biofuels. The normative policy beliefs were either pro environment or pro economic development, while the empirical policy beliefs focused on the carbon dioxide intensity of crop based biofuels, accounting methods, the impact of EU biofuels on African food security and indirect land use change effects. ENV changed its empirical policy beliefs to reflect its stable normative policy beliefs on environmental protection. This change in empirical policy beliefs exposed the pre-existing conflict with the normative policy beliefs of ECDEV. As a consequence, the collaborative policy subsystem shifted to an adversarial policy subsystem. Beliefs did not converge over time, but diverged due to scientific evidence. These findings confirm that science matters in policy making, but it can also increase uncertainty and result in conflict among actors.

Conflict between advocacy coalitions played out in multiple venues, starting in the European Commission as the sole institution to propose legislation. As DGs represent all kinds of sectoral interests with corresponding underlying beliefs (e.g. environmentalists versus economic growth-focused directorates), the European Commission became the primary venue for disagreements among coalitions. These spilled over into the European Parliament and Council as secondary arenas, while a strong influence of European Commission representatives prevailed due to their high expertise on the issue and familiarity with the policy proposal (Braun, 2009; Hooghe, 2012). The disagreement between the biofuels advocacy coalitions resulted in policy lock-in effects and inertia that became increasingly difficult to overcome. The coalitions used institutional power structures such as the leadership of DG Environment and DG Climate Action on the Fuel Quality Directive and the responsibility of DG Transport and Energy for the Renewable Energy Directive to embed their belief-based interests. This resulted in a path dependency of European biofuels poli-

cy (Kay, 2003) as farmers and businesses make their investment decisions. This contribution carries policy implications by widening the scope for understanding 'policy failure' from a perspective of contested beliefs, which results in different interpretations of scientific evidence and also highlights the difficulties of 'escaping' policy lock-ins and path dependencies that were created during periods of scientific uncertainty. It thus improves our understanding of the underlying beliefs and mechanisms leading to policy outcomes that require in-built reforms remedying unintended (environmental) consequences to "avoid another 'biofuels' disaster" in the future (ENV EC 12).

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Appendix

Table 1. Differences between collaborative and adversarial policy subsystems. Based on Weible (2008: 622-628).

	Collaborative policy subsystem	**Adversarial policy subsystem**
Belief compatibility between coalitions	Moderate to high, overlaps on some belief levels	Low to none
Governance of institutions	Policies negotiated in various consensus-based institutions, high coordination between coalitions	Little or no coordination between coalitions, but high coordination within coalitions; coalitions compete for access to authority and try to influence decisions in any suitable venue, policy proposals seek to benefit own members in a win-lose manner and can be coercive or prescriptive in their means
Role of experts and use of knowledge	Experts reconcile differences in theory, methods and data; instrumental use of knowledge	Experts disagree on methods, theory and data, serving as principal allies or opponents to coalitions; the use of scientific knowledge is predominantly political
Intensity of learning between coalitions	High, uncertainties are acknowledged and taken into account	Scientific uncertainty is used for political gains, with a high level of learning within coalitions (on how to better 'play' politics), but not between coalitions

Figure 1. Link between use of knowledge, stability of empirical policy beliefs, balance of power between coalitions and changes in policy subsystem due to new scientific knowledge. Complied by Author, based on Weible (2008) and Weible and Sabatier (2009).

Use of knowledge	**Instrumental**	**Learning**		**Political**
Stability of empirical policy beliefs	Static	Dynamic (belief changes) following reflection on the new knowledge, i.e. actors need to engage and deliberate with information as precondition for learning ↙ Actors change beliefs to reflect new knowledge ↘ Actors do not change beliefs, ignore new knowledge		Static
Balance of power between coalitions	New knowledge reinforces beliefs of actors, strengthens the power of advocacy coalition and allows it to take 'high moral ground'		AC powerful enough to suppress knowledge: ignore, discard or bury evidence as it conflicts beliefs the AC wants to hold on to AC not powerful enough to bury evidence, so focus on discrediting by questioning methodology, commissioning counter-studies and cherry-picking evidence matching beliefs	
Changes in policy subsystem due to new scientific knowledge	Policy subsystem remains stable if new knowledge reinforces status quo	Policy subsystem shifts to reflect belief constellations of advocacy coalitions, i.e. from collaborative to adversarial if beliefs are opposed, or from adversarial to collaborative if beliefs between coalitions become aligned due to belief change of other coalition	Policy subsystem remains stable if new scientific knowledge is ignored	

Table 2. Belief changes among the two advocacy coalitions. Source: Author.

	2000-2007 **Collaborative Policy Subsystem**		**2007-2014** **Adversarial Policy Subsystem**	
	ENV	**ECDEV**	**ENV**	**ECDEV**
Deep core beliefs	Deep green	Economic development & energy security	Deep green	Economic development & energy security
Normative Policy beliefs	Principled priority of environmental sustainability	Principled priority of economic development	Principled priority of environmental sustainability	Principled priority of economic development
Empirical Policy beliefs	All REs, including biofuels, are good to address climate change	All REs, including biofuels, are good to address climate change, plus co-benefits for energy security and rural development	Food based biofuels are unacceptable to meet climate targets (CO_2 intensity, food-vs-fuel effects)	All REs, including biofuels, are good to address climate change, plus co-benefits for energy security and rural development
Secondary beliefs	Increase share of REs overall and biofuels to 10%	Increase share of REs overall and biofuels to 10%	Stop increase of food based biofuels and phase-out, strengthen sustainability criteria	Increase share of REs overall and biofuels to 10%
Use of knowledge	Political (to achieve climate targets)	Political (to achieve triple-objective), creation of policy lock-in via convincing Council to commit to biofuels target	Learning and political (deliberate new scientific evidence)	Learning and political (find scientific studies that back up political objectives and counter environmentalist's arguments)